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Eos, Transactions, American Geophysical Union Planetology 6510 Atmospheres of planets AS ESTIMATE OF THE BY DENSITY IN THE ATOMIC HYDROGEN AS ESTEMATE OF THE M. DEPSITY IN THE ATOMIC INTOROGEN CICLO OF VITAM V.-R. IP (Max-Platch-Institut (fir Asronomis, D-1311 Fatlesburg-Lindau 1, Federal Republic of Germany) Charged particle superisents on the Voyager space-craft at Saturn can be used to provide some useful estimates on the charge scakings less rate of magnetospheric particles in the atomic hydrogen cloud of High. The thereal places instrument measured the names of meanity and inm and electron temperatures of the corotating places and thus the there exchange lies these scale of the sources lies of the series of the corotating places and thus the there exchange lies these scale of the sources lies of the series of the corotating places and thus the there exchange reaccellanting of the hot magnetapheric places. These observational results trighther with known reaction rate coefficients can be seed to occupie the total N = N2 density in the hydrogen storus. As the Voyager US expectional decay are seed to occupie the total N = N2 density in the neutral torus region can be assimated. This mathod leads to an N2 density value of < 10 cm⁻³, considerably less than the limiting value for the balliatic action of the neutral particles to be collisionally dominated. J. c. e. + vol. Fig. A. Pajor 140016

Vol. 65, No. 4, Pages 25-32

January 24, 1984

CAN Peter states 11-20 per security to a comparison of the compari

Allish and Flaus Fell of the Pasico, Albuquerque, by the particle and electro-probe study of entation main Fils, 4 and 5 chandraise, including the previously undescribed Allan Fils A 2715e, provides no support for laters and Sath's [1982] and I which create molimatesizate are mised. We find that Cr and Provide the area of the control of the first and disable are not entated partially maintained and of another partially maintained and alimbolas are not uniquely defined by their article and elementary among characters about Mile variations in constitutions of the previous masterial. However, a restant are probably jurgely due to tractionation for the previous due to tractionation for the previous first the second of privilegic type with minus element element for the pasing of privilegic type with minus element element.

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account for the different shargottite sources. The large ion lithophila (LIL) trace element abundances of the shergottites require variable but extensive degrees of non-modal melting of isotopically constrained parent sources. The extreme attent of such melting is hypothesized to be represented by ANA 77005 as a residual composition. Derivation of a pre-1.3 AC(10 yr) fractionation sequence is suggested in which ol, oll-op, optipe, and opsicp-splay sequentially produce residual liquids capable of accounting for the precursor sources for the SKC reteorites. On the basis of chemical, isotopic and petrologic considerations we conclude that the SYC sources are consistent with their derivation by extensive fractionation of a primitive magna initially produced from a source having chondritic refractory littrace element abundances. Fei (Fe/Fe-Mg storic) = 0.3, and a mineralogy primarily of ol and bys. Our model dependent deductions suggest that this magna could be derived without plagioclase or garnet left in the residuen. Petrogenetic and age relationships among SKC metaorites suggest a single complex-provenance on a dynamic planet not unlike the earth. Considering that each of these reteorites possesses chemical, isotopic and petrologic features consistent with date presently available from Mars, we conclude that a Rartian origin is quite probable.

hys. Res., Earth, Paper 385020

i. Guophys. Res., Earth, Paper 185020

6175 Surface of Planate
GEOLOGIC EVOLUTION OF GALLED REGIO, GAMMEDE
RUGARC CESSACHI (IAS-Reperto di Pissetogia, V.1s
Universita, 11-00185, Rome, Ttaly) Robert G. Strom
The guology of Galileo Regio is charanterized by:
(1) two principal morphologic terrain bulks (rough and
smooth learains), (2) craters in various states of
Preservation, and (3) a tateolo framework consisting
of these furrow systems of different ages. The three
furrow systems the neoth to the disameter. A broadly arounde
furrow system tomeet the rough terrain but pre-date
all other terrains as well as the oldest craters
inter than about 10 im disameter. A broadly arounde
MM-EE furrow system dominates the tectosic pathern and
is intermediate in age between widely spaced MM-EM and
Instrumediate in age between widely spaced MM-EM and
Instrumediate in age between widely spaced MM-EM and
is intermediate in age between widely spaced MM-EM and
is intermediate in age between widely spaced MM-EM and
is intermediate in age between widely spaced with
the dominant furrow system. The distribution of
smooth terrain on Galileo Engle on probably resulted
from fluid extrusions along fractures associated with
the dominant furrow system. The distribution of
smooth terrain on Galileo Engle on the superish in the
account of the furrow system is very
secretial. The age relationships, sorphology and
geometry of the furrow system do not favor an origin
by impast or their streaming and not favor an origin
possibility, origin is evental spilife caused by a
pluss-like convection cell in a fluid smeath
morphologic relationships among, furrows and crater
pallupsels suggest that palimosest morphology is
largely the result of impash into a rheologically weak
treat resher than viscous relaxation.

1. Geophys. Row., R. Paper 195128

undifferentiated body initially penetrate to great depths. but rapidly concentrate within a few kilometers of the surface. For the differentiated body, elastic atreases never accumulate at a depth greater than a few kilometers. These models are applied to consider long-term radioactive heating as a possible mechanism of tactonic activity and bright terrain formation on Ganymede. (Ganymede, thermal evolution, icy astellites).

1. Googhes, Runs., B. Paner 385114

Solar Physics, Astrophysics, and Astronomy

7710 Corona CROSSAN MASS EJECTIONS OBSERVED DURING THE COLAR MAIN MISSION: LATITUDE DISTRIBUTION AND RATE OF OCCUPRING A. J. Hundhausen (High attitude Observatory, Rational Canter for Atmospheric Research, P.R. Box 3000, Bould's Colorado, 80307), C. Sawyor, L. House, R. H. E. 11149 and W. J. Wagner
Sisty-five coronal mass ejections have been identified in a systematic examination of white-light compainings obtained between March and September, 1980, in the Coronagraph/Palarimeter flown on the Solar Masion (SNM) Spaceraft. These ejections were morn uniformly distributed in position angle (or "projecter solar latitude) than the similar events observed from the Stylab mission in 1973-1974; 27% of the SM and the Stylab mission in 1973-1974; 27% of the SM and the Stylab mission for the entire SM exchange the observed mass ejections for the entire SM exchange of the solar equator. The average rate of occurrence of the observed mass ejections for the entire SM exchange of the system supplies that one coronagraph may propagate and the system of assumption to the Skylab data set leads to a rate of 0.75 per 24-hour day and thus a change in this rul from the Skylab era (on the declining phase of sampet cycle 20) to SMM (near the maximum of sunspot cycle 21) of only 20%. Geophys. Res., A, Paper 3A1943

7710 Corona (Coronal Transients)
ORSITY DISTRIBUTION IN LOOP-LIKE CORONAL TRANSIDIST
A COMPARISON OF ORSENATIONS AND A THEORETICAL MODE.
D. 6. Sime (High Altitude Observatory, National Deliase for Atmospheric Research, Boulder, Colorado, 80307).
R. M. MacQueen and A. J. Hundhausen
Evanination of the Intensity Changes in five entroronal "loop-like" transients observed by the Styla, coronagraph shows general tendencies for: (1) Grainst concentration of material at the Flanks rather than at the tops of the bright loops that characterize that the tops of the bright loops that characterize that transients; (2) Presence of a large ragion of deplant density within these loops; (3) Development of bright logs that contain most of the material in the transients of the bright loop moves radially elevations and that display very little lateral motics that top of the bright loop moves radially elevations of the observed density distributions the outer proons. These properties of "loop like" coronal transients provide useful constraint of theoretical models of this phenomenon, in particular, direct comparison of the observed density distributions with those pradicted by models of compressional loop, rather than at the financement at the for one loop, rather than at the financement at the for one loop, rather than at the financement at the for one laterally with a significant fraction of the brooker than so have the geometry assumed in the compressive models ("boroidal symmetry" about a rotation and basing through the center of the sim), the prediction, has shell and the scholar of a genuetry which conflicts with the center of the sim), the prediction, he scholared distributions, the product of the production of the scholar distributions, the scholar of a genuetry which conflicts; with Late tised for the model calculation, the product of the scholar distributions.

Yews

New Radio Telescope

A new radio telescope to be placed atop 4205-m-high Mauna Kea in Hawaii will be the largest telescope of its kind ever built. and will open up previously unexplored submillimeter wavelengths to observation by astronomers when it begins operations in early 1986. The 10.4-m diameter dish antenna is being constructed by the California Institute of Technology, using \$3.9 million in funding from the National Science Foundation.

The dish will be able to collect radio waves as short as a third of a millimeter, shorter than any other radio telescope now in operation. This will allow investigation of a new region of the spectrum important to the suidy of interstellar molecular clouds, among other celestial objects.

The antenna and its mount have already been built, and a dome 18 m in diameter is being constructed at Caltech to shield the telescope from weather and solar radiation and to house its control and support equipment. Matina Kca, an extinct volcano, was chosen as the telescope site because it is dry and high enough to cut down on the disturbing effects of the atmosphere.

The radio dish was designed by Robert B. Leighton, and the facility's director will be Thomas G. Phillips, both of Caltech. The telescope is expected to be available for use by the national astronomical community approximately 50% of its working time.

Global Warming

A study prepared for the National Science Foundation (NSF) by engineers and economists at the Massachussetts Institute of Technology (MVT) and Stanford University concludes that the global warming caused by buildup of carbon dioxide (CO2) in the atmosphere during the next century can at least be slowed down it we learn to use nonpolluting energy sources more efficiently. It will take international cooperation, however, and prompt action to keep the greenhouse effects

The report follows on the heels of two separate studies released in October by the National Research Council and the Environmental Protection Agency on carbon dioxide and global warming (E_{10} , November 15, 1983, p. 929). Like those groups, the NSF study panel believes that "a significant . . . warming in the next century probably cannot be avoided." However, "the rate of increase of atmospheric CO2 due to fossil fuel consumption can be significantly reduced via the adoption of realstic energy strategies that are relatively 'CO2-The so-called greenhouse effect is caused when carbon dioxide and other gasses create an atmospheric blanket that traps heat near the surface.

According to the report, the best way to stop pumping CO2 into the atmosphere is to make the transition from fossil fuels to cleaner forms of energy as soon as possible. The NSF group is particularly interested in elec-tric power. "The trend toward a more electric future world, coupled with the fact that most non-fossil energy options are electric, indi-cates the need for and benefit of studying fu-

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ordinator

ture electric systems closely." Other alternative energy sources such as nuclear fission and photovoltaic cells were also mentioned as

worth pursuing.
The report, which was prepared by Carson
Agnew of Stanford and David Rose and Marvin Miller of MIT, says that "it makes sense to develop new strategies for reducing future fossil fuel carbon emissions, rather than relying solely on research to narrow uncertainti nd/or ameliorative measures such as building dikes and developing new strains of greenhouse-resistant crops." Increased energy productivity would be desirable for political and economic reasons other than just slowing the CO2 buildup, the report further

If worldwide efforts were made to reduce the reliance on fossil fuels, the NSF group predicts that it would take several centuries for atmospheric CO2 concentrations to dou ble, as opposed to the 100 years predicted by the NRC report. The group believes, lowever, that stringent measures to restrict the use of fossil fuels at this time "are both unjustified and infeasible."

Like the other greenhouse study groups the NSF panel calls for more research and debate. "We conclude, after studying acid rain and other examples, that the time is propitious for cularging the global discussion on the greenhouse effect." Single copies of the report, titled "Global Energy Futures and COa Induced Climate Change," are available from NSF's Division of Policy Research and

NASA Launch Schedule

The National Aeronautics and Space Administration (NASA) has a record-setting kunch schedule for 1984—10 space shuttle flights (see Table 1), 10 satellite deployments from the space shuttle in orbit and 12 un-manned missions using expendable launch vehicles. Also scheduled is the launch on March 1 for the National Oceanic and Atmospheric Administration of Landsat D', the nation's second earth resources satellite.

The launch activity will begin February 3 with the launch of shuttle mission 41-B using the orbiter Challenger. Two communications satellites will be deployed from 41-B: Westar-VI, for Western Union, and Palapa B-2 for the government of Indonesia. The 8-day mission will feature the first shuttle landing at Kennedy Space Center in Florida; and the first flight of the Manned Maneuvering Unit. a self-contained, propulsive backpack that will allow astronauts to move about in space with out being tethered to the spacecraft.

After the March I launch of Landsat D' from the Western Space and Missile Center at Vandenberg Air Force Base in California. control of the satellite will pass to NOAA.

Shuttle mission 41-C with orbiter Challenger is scheduled for April 4. The highlight of this 6-day flight will be the repair of the Solar Maximum Mission satellite, launched February 14, 1980, for scientific studies of sular flare activities. The astronauts will perform a spacewalk to stabilize the spacecraft so it can be grappled by the remote manipulator system and berthed in the cargo bay for the re-

Space Shuttle orbiter Discovery is scheduled to make its debut June 4 on flight 41-D. Payloads on this 7-day mission include the Large Format Camera and the Office of Aeronautics and Space Technology-1 pallet, to conduct investigations in space technology. In addition, two communications satellites will be deployed: Telesat-1 for Canada and Syncom IV-1 for Hughes. Shuttle flight 41-E using orbiter Challenger is a Department of De-fense (DoD) mission scheduled for July.

You can now communicate with August will be NASA's busiest month with three unmanned mi sions, and three satellite deployments from the Shuttle, NOAA-F, a weather observations satellite, will be launched from the Western Space and Missile Center. Intelsat VA-B, a COMSAT communications satellite, will be carried aloft on an Atlas Centaur; and the Active Magnetospheric Particle Tracer Ex-plorer, a space physics mission cooperative with the Federal Republic of Germany, will be launched on a Delta, both from the East-

ern Space and Missile Center. On August 9 shuttle mission 41-F, a 7-day flight with orbiter Discovery, will feature the first autoland at Edwards Air Force Base, Calif. Payloads on this flight include SPAR-TAN-I (a new class of small astronomical payloads that would normally fly aboard a sounding rocket) and the deployment of three communications satellites: SBS-D, for Satellite Business Communications; Syncom IV-2, for Hughes; and Telstart S-C, for

Shuttle mission 41-G, a 10-day flight of or-biter Columbia, is slated for August 30. The cargo includes OSTA-3, the Earth Radiation Budget Experiment and SPARX-1, a com-mercial remote sensing payload. Scheduled for September 28 is shuttle mission 41-H with

TABLE 1. Planned 1984 Space Shuttle Launches

Date	Numbers	Shuttle	Mission
Feb. 3	41-15	Challenger	SPAS-01A, Palapa B- 2, Westar-VI
April 1	41-C	Challenger	Solar Max Repair Mission; Long Du- ration Exposure Facility
June 4	41-D	Discovers	Telesat-I, Syncom 1V-1, Large For- mat Camera, OAST-1
July 14	414.	Challenger	DaD mysion
Aug. 9	41-F	Dwaren	Telstar 3-C, SBS-D, Syncom IV-2, SPARTAN-1
Aug. 30	41-G	Columbia	OSTA-3, ERBS SPARX-1
Sept. 28	41-H	Challenger	DoD mission or FDRS-B
Oct. 24	51-A	Distances	MLS-1. Telesat-H, GAS Bridge
Nov. 21	51-B	Challenger	
Dec 17	51-C	Discovers	TDRS-B or TDRS-C.

orbiter Gudlenger. The payload for this mission will be either a DoD mission or the dedoyment of TDRS-B, the second in the series of three satellites in NASA's Tracking and Data Relay Satellite System.

Shuttle flight 51-A with orbiter Discovery is scheduled for October 24. Payloads on this 6day mission will feature the Materials Science Laboratory, a self-contained facility to provide accommodations for experiments in the materials processing field; the GAS Bridge, a structure across the payload bay designed to hold additional Getaway Special canisters; and the deployment of Telesat-11, a Canadian communications satellite. Shuttle mission 51-B, a 7-day (light of orbiter Challenger, will be launched on November 21 with Spacelab 3 as its cargo. Spacelab 3 will be the first operational Hight of the Furopean-brule laboratory.

The 10 shattle missions will be double the number of manned flights in any year of the agency's history. During the Gemini program, five manned missions were flown in both 1965 and 1966.

Winding up the year on December 17 is duttle mission 51-C with orbiter Discovery The payload for this 7-day flight will be the Materials Science Laboratory 2 and either the TDRS-B or TDRS-C NASA communications suellite.—PMB

JOI To Manage Drilling Program

The Joint Oceanographic Institutions, Inc. ([OI), has been awarded a 5-year, \$141 milion contract by the National Science Foundation (NSF) to manage and operate the Ocean Drilling Program (ODP). The international scientific program follows the 15-year Deep Sea Drilling Project (DSDP) and is expected to last a decade. JOI, founded in 1976 to manage scientific services and planning functions for DSDP, is based in Washington, D. C., and consists of 10 major oceanographic

Drilling operations are expected to begin in October at the start of fiscal 1985. Negotiations are under way to lease a commercial drill ship for the program (*Eos.* May 5, 1983, p. 174; February 22, 1983, p. 73). According to D. James Baker, Jr., JOI president, and Sandra D. Toye, ODP program director, a decision on the choice of the research ship is likely to be made in February; overhaul of the commercial ship to make it suitable for scientific drilling is scheduled to be done by October. The Glumar Challenger had been leased for 15 years as DSDP's drill ship.

Plans for ODP's first year call for scientific drilling to start in the Gulf of Mexico and the Blake/Bahamas area in the Atlantic, followed by work on the mid-Atlantic ridge and in the Labrador Sea. Near the end of the first year of operation, the drill ship will head toward the Mediterranean Sea.

Texas A&M University will be ODP's science operator, responsible for the lease and conversion of the vet-to-be-selected drill ship and for the provision of logistical support and scientific services on the ship and on shore. The Lamont-Doherty Geological Observatory of Columbia University will coordinate the program's logging services. The Joint Occanographic Institutions for Deep Earth Sampling (JOIDES) provides the scientific planning for the ocean drilling program.

Countries that participated in DSDP-namely the Federal Republic of Germany. France, Japan, and the United Kingdom-are expected to continue in the new program. In addition, Canada and a consortium repre-sented by the European Science Foundation are "candidate members" and will participate in planning activities this year. Several other countries are considering membership. These partner countries together contribute about one third of the scientific personnel and financial support --- BTR

Recent Ph.D.'s

Eos periodically lists information on recently ac-cepted doctoral dissertations in the disoplines of geophysics. Faculty members are invited to submit the following information, on institution letterhead, above the signature of the faculty advisor or depart-

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nsumtem, (1) faculty advisor, (5) month and year degree was awarded.

phone mumber of the degree recipient (this information will not be published). Dissertations with order numbers, and many of the others listed, are available from University Microddins International, Dissertation Copies, P.O. Box 1764, Aun Arbor, MI 48106.

If possible include the current address and tele-

Absolute Number Conventination Measurement of Submicrometer Particles (Condensation Nuclei). Teh-Hsun B. Chen, Univ. of Rochester, 1982 (GAX83-22061).

Analyses of Extraterrestrial Materials in Terrestrial Sediments (Denmark, Indum Partie, Suleraphile, Meteoriter, Frank 1. Kyte, Univ. of California, Los Angeles, 1983 (GAX83--22an h.

Bismuth, Nukel, and Palladoon in Northrast Pacife Waters: Novel Analytical Methods in Mavine Chemistry, Dong S. Lee, Univ. of Cali-Jornia, San Diego, 1983 (GAX83-19123). Bottom Pressure Observations on the Continental Shell (California), M. Rustin, Erdman, Univ. of California, San Diego, 1983 (GAX83+ 22794).

Comparison of Steady State Fransitions in Truncated Spectral and Finite Difference Models of Two-Dimensional Shallow Convection, Hat-Ru Chang, Pennsylvania State Univ., 1983. (GAN83-20872)

Debuggion and Persistence of Polyninkar Arabat it Hydrocarbons After Slash Burning Char-Cut-Siles in Oregon, Timothy J. Sullivan, Oregon State Univ., 1983 (GAN83-20427). Development, Testing, and Leabation of a Muco

computer System for Kapid Collection and Anal-Asis of Gralogic Structure Data Related to Rock Slope Multility (Virginia), Chester L. Watts. Purdue Univ., 1983 (GAN83-24074).

Diagnostic Case Study of the Lifects of Deep Lytintropical Convection on the Large Scale Femperature and Maisture Structure, Ying-Hwa Kuo, Pennsylvama State Univ. 1983. (GAN83-20897)

Distributional Differences of Codming and Mexicos in Propary Monolayer Cultures of Adult Rat Hepatocytes, Ronald J. Gerson, Univ. of Rochester, 1983 (GAX83-22071).

Effect of Slope Gradient and Aspect on the Genesis of Soils Formed on a Sandstone Rulge in Central Pensylvania, Brian J. Carter, Pennsylvania State Univ., 1983 (GAX83-20871).

Environmental Management of Pacific Outer Con-tinental Shelf Oil and Gas Activities by the Minerals Management Service (California), Joan P. Licari, Univ. of California, Los Angeles, 1983 (GAX83-22005).

Grochemistry of Fluid Inclusions and Hydrothermul Alteration in Vein- and Fracture-Controlled Mineralization, Stockwork Molybdenum Deposits, Mark S. Bloom, Univ. of British Columbia, 1983.

Geology of the Covmox Hills and Its Relationship to the Ruby Creek Cooper-Cobalt Depost (Alaska), Murray W. Hitzman, Stanford Univ., 1983 (GAN83-20723).

Hydrogeolog, and Geomorphology of the Great Sauford Outwash Plain, York County, Maine With Particular Emphasis on the Branch Brook Watershed, Denis W. D'Amore, Boston Univ., 1983 (GAX83-19966).

Mineralogical, Textural, and Paragenetic Studies of Selected (the Deposits of the Southeast Missou-ti Lead-Zine-Capper District and Their Genetic Implications, Kenneth B. Horrall, Univ. of Missouri-Rolla, 1982 (GAX83-20833). Modelling Hydrogeochemical Processes With the

Mass Transfer Model WATEGM-SE, Carl D. Palmer, Univ. of Waterloo, 1983. Ocean Temperature Changes Induced by Tropical Cyclones, Peter G. Black, Pennsylvania State

Univ., 1983 (GAX83-20865). Origin and Paleoenvironmental Significance of Pediments in the Bighorn Canyon Area of ' Southcentral Mantana (Diameton, Eroswa). Gerald L. Nelson, Univ. of Kansas, 1983

(GAX83-17910). Pedagenesis of Sodium Ion- and Magnesium Ion-Affected Sedgefield Soils (Fine, Mixed, Thermic, Aqualtic Haphulalys) in the North Carolina *Piedmont*, Farzad Dadgari, North Carolina State Univ. at Raleigh, 1983 (GAX83-18939).

Possible Tidal Modulation of the Indian Monsoon Onset, William H. Campbell, Univ. of Wisconsin-Madison, 1983 (GAX83-16201). Seasonal Freshwater Wetlands Development and Potential for Urban Runoff Treatment in the San Francisco Buy Area, Gary S. Silverman. Univ. of California, Los Angeles, 1983 (GAX83-22029).

Some Effects of Surface Heating and Topography on the Regional Secree Storm Environment, George S. Benjamin, Pennsylvania State Univ., 1983 (GAX83-2086-i).

Books

Krakatau 1883: The Volcanic Eruption and Its Effects

from Simkin and Richard S. Fiske, Smithsonan Institution Press, Washington, D. C., 464

Reviewed by Johan C. Varekamp

Daring the last couple of years, scientific and general interest in volcanos has surged as a result of the lively performance of Mr. St. Helens, and that's why Krabatan 1883 prombes to become a good seller. What does it ofter? The writers began the volume with a detailed chronology of the emptions, eyewitness accounts, and media coverage that cover local and regional effects, the isimamis and their catastrophic results, and the sonic effects. Next is a section with translated parts of Verbeek's monumental monograph on the 1883 cruptions, labowed by reprints of other scienthe papers, and summaries of recent work on the event. For those deficient in French or Dutch, the translation of Verbeek's work will be especially welcome, because this civic engiover described and interpreted a colossal amount of data

Since volcanic cruptions belong to the small group of geological phenomera in which something happens during a time span accesable to humans, the value of evenitues accounts should not be underestimated. Many speculations and interpretations could have been tested if we could have been there at the time, so the stories of local Dutch citizens are particularly useful. One can ask, of course, how reliable are the descriptions of many of . the phenomena. In my own experience, in interviews with books after a major emption. people tend to tell that a village was covered by 50 cm of ash while you just measured 3 on However, from the wealth of accounts published in the Krakatan book, many prominear features of the cruption are repeatedly mentioned in evenings, accounts.

Gory details of human suffering do not alound in the book. It was written with the Tiymare in mind, given the inclusion of papers early accessible to the scientific community The writers have succeeded in bringing together matas details of the eroption, summatizing its would wide effects, and at the same time performing us a glumpse into the world of Durch colourd bre at the turn of the centu-

For the professional, there is much to sayour in the original descriptions of the prodacts and of the changing morphology of the islands. Also, we can sense the evolution of scientific thought. It is interesting to observe

how logical some of the old, now-ridiculed ideas sound when set forth using their arguments and observations. Verbeek's meticulous descriptions make his data excellent for reinterpretation. Current thinking on the eruption is that the caldera formed by collapse, that the eruptions were not phreatomagmatic (although many steam blasts were observed and accretionary tappilli and mud are commonly cited in the eyewitness descriptions), and that magina mixing occurred prior to or during the cruption. Interesting details mentioned are the high salt contents on the ash, either condensates of magnatic vapor or resulting from seawater evaporation, and the presence of big churcks of dense obsidian in lle ash beds.

In most eyewitness accounts, complaints were voiced on the irritating smell of sulfur мрог, and since the smell of rotten eggs is never mentioned, one may assume that SO2 vas the dominant sulfur-gas species during the eruption. Puzzling features are inclusions of pyrite noted in the feldspar phenocrysts (S-rich magniar) and low crystal contents of

important problems remain: Is the mixedin basaltic magma component similar in com-position to the Anak Krakatan magma? Is there a parent-daughter relation between the 1883 magnia and that basaltic magnia? A detailed petrologic study of the products is much needed. The book's reference list covcts most of the English-language literature on the cruption. For the price of \$15 this book is a real bargain)

Johnn C. Varekamp is with the Department of Earth and Environmental Sciences, Wesleyan University, Muddletown, CT 06-157.

The Ocean Floor

Bruce Heezen Commemorative Volume, R. A. Scrutton and M. Lalwam (Eds.), John Wiley, New York, ix + 318 pp. and pocket maps,

Reviewed by Paul J. Fox

Over a relatively short period of time Bruce Heezen made significant, imaginative and timely contributions to our understanding of the processes that govern the origin and evolution of oceanic crast in space and time. It is certainly fitting that someone of Herzen's stature be honored by a memorial volume and the collection of papers in The Ocom Floor were gathered together for this purpose. Bruce was a gifted scientist with a wide-ranging appetite for all facets of earth science, and in this respect he would have appreciated the pot pourri of marine geological topics covered in the book te.g., continental

Geophysical Monograph 28

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Introduction to

authors, after having agreed to contribute to the volume, reached deep into their files to dredge up a neglected manuscript on one subject or another. As a consequence, many of the papers lack zest and fail to stimulate interest beyond their narrowly focused Of the 18 chapters, however, there are sev-

margin investigations, sedimentological pro-

cesses, plate tectonic models). Unfortunately,

the book does not have an overall impact that

measures up to the man that it commemo

rates. Too many of the papers read as if the

eral papers of merit. An investigation of the biogenic mixing problem as expressed in a suite of high latitude North Atlantic cores, by ddiman and Glover, presents new data that leads to a more realistic understanding of this important process. The factors governing the evolution of submarine canyons are discussed in two papers that summarize submersible investigations of canyons off the eastern U.S. (Malahoff et al.) and submersible and multi-narrow beam studies of canyons off the French continental margin (LePichon and Renard), and these contributions nicely elucidate the range of processes that control the pinent of canyon morphology. Heezen had a gift for imaginatively summarizing a broad range of geologic data for a region. and papers by Seibold and Fütterer and by Jones and Mgbatogu on the west African margin and a paper by Vanney and Johnson on the geomorphology of the Kerguelen-Antarctica Passage are excellent syntheses in the Heezen tradition. A short review of the insightfully imaginative mapping carried out by Heezen and Tharp over 25 years is nicely documented by M. Tharp and should be required reading by all students of the sea

At its price of more than \$100 I can recommend it only to those individuals who can afford to keep a well-stocked library. Bruce Heezen deserves a commemorative volume filled with benchmark papers and I am afraid that this book, to quote R. A. Scrutton in the book's preface, is but a "modest memorial to one of the greatest oceanegraphers of post-World War II years."

Paul J. Fox is with the Graduate School of Oceanography, University of Rhode Island, Kings-ton, RI 02881.

The Earth Through Time

H. L. Levin, 2nd ed., Saunders College Publishing, New York, viii + 513 pp., 1983.

Reviewed by Stanley A. Mertzman

The Earth Through Time successfully fills a gap in the world of introductory level geology lextbooks, a gulf created by the nature of typical undergraduate students. The introductory course laught at many institutions is physical geology wherein potential geology najors and students who simply want to fulfill part of a natural science requirement form a cosmopolium class. Students who are convinced that geology is the major for them go on to historical geology in the second se-mester often using the Dott and Batten text, Evolution of the Earth, a text that is rigorous and designed strictly with the geology major in mind. Based on my experience, however, a sizable number of students who have no intention of majoring in geology desire to take a second course in the field out of pure interest and as a means of satisfying the second part of a typical 2-semester science requirement. The Earth Through Time provides a via ble alternative to Dott and Batten's book, one certainly as broad in its overall coverage but with discrete topics—such as local stratigraph-ic nomenclature and detailed discussions of geology outside of North America-being de-

The chapters "Life through Time," "Time and Geology," and "Human Origins" are particularly well written. The illustrations us explain the concept of absolute geologic time are especially effective. Also, the presentation of a separate section on economic resources at the end of each era of geologic time is a useful innovation. The writing style is concise and informative; there are few typographical errors to mar the readability of the text. Students will find quite helpful as study aids the review questions and the terms-to-remember section listed at the end of each chapter as

well as the text's extensive, 22-page glossary. In my opinion it would be advantageous, in the next edition of this text, to add a 1-page Periodic Tuble of the Elements to the intro ductory chapter concerning earth materials and to greatly expand Appendix A (Classifi-cation of Living Things), making it a capsule review of the paleomologic aspects of histori-cal geology of the sort found in Kummel's History of the Earth. Everything considered, I highly recommend Levin's The Earth Through Time to all teachers of earth history courses.

Stanler A. Merteman is with the Department of Staties A. Ateriaman is with the Department of Geology, Franklin and Marshall College, Lancas-ter, PA 17604. He is on a 1-year appointment to the Department of Terrestrial Magnetism, Carnegie Institution of Washington, Washington, DG 20012

AGU New Books

Magnetospheric Currents, Grophys. Monogr. Ser., vol. 28, edited by T. A. Potemra, x + 357 pp., color and black-and-white illustrations, AGU, Washington, D.C., 1984, ISBN 0-87590-055-0, AGU members, \$23.10; others.

When viewed from outer space, the earth's magnetic held does not resemble a simple dipole but is severely distorted into a cometshaped configuration by the continuous flow of solar wind plasma. A complicated system of currents flows within this distorted magnetic field configuration, called the "magnetosphere." For example, the compression of the geomagnetic field by the solar wind plasma on the dayside of the earth is associated with a large-scale current flowing across the comagnetic field lines, called the Chapman-Ferraro or magnetopause current. The magnetospheric system includes large-scale currents that flow in the "tail," "Birkeland" currents that flow along geomagnetic field lines into and away from the two auroral regions the ring current that flows at high altitudes around the equator of the earth, and a complex system of currents that flows completely within the layers of the ionosphere, the earth's ionized atmosphere, the intensities of these various currents reach millions of amperes and are closely related to solar activity. A Chapman Conference on Magnetospher

ic Currents was held at the Tides Inn in Irvington, Va., April 5-8, 1983, for the purpose of bringing together scientists and students interested in electric currents in the earth's and other planets' magnetospheres. The knowledge in this area was reviewed and remaining questions were identified. Over 90 registrants from four continents participated in formal presentations, poster sessions, and informal discussions. Forty-two of the conference papers were submitted, and following a peer review of each paper, 37 were accepted for publication in this volume.

It was very appropriate to have this conference as part of the series named in honor of Sydney Chapman because he contributed so much to our understanding of currents in the earth's ionosphere. This volume includes historical articles describing some of Chapman's work, the contributions that Kristian Birkeland and Hannes Allvén made to an understanding of magnetospheric currents, and re-flections on the scientific interactions between these three great scientists. These articles are included with the hope that some insight can be gained into the complex scientific and personal processes involved in the development of an understanding of our physical environment. It is hoped that the scientific articles included in this volume achieve the conference goals of consolidating and summarizing the present knowledge of magnetospheric currents and of stimulating new research ar-

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cas. (From the Preface by T. A. Potema.)

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Cover. Schematic drawing of earth's magnetic field showing its configuration under the influence of the flow of solar wind plasma. Illustration from a new AGU book, Magnetospheric Currents, edited by Thomas A. Potemra and based on pa-pers presented at the April 1983 AGU Chapman Conference on Magnetospheric Currents. For a description and table of contents of the book, see p. 34.

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A resume and the names of three persons knowledgeable of applicant's experience allowed be forwarded to: L. A. Frank, Department of Physics & Astronomy, University of Iowa, Van Allen Hall, Iowa City, Iowa 52942.

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Marine Research Associate III. Process, analyze and interpret satellite derived thermal IR data of the Sargaso Sea from the subtropical convergence to the Gulf Sucarn. Prepare scientific manuscripts on the results emphasizing the near surface meso-scale dynamics and nir/sea interaction. Ph.D. in Physical Cacanography and experience in computer programming. Submit resume by March 1, 1984, to: Peter Cormilon, Marine Research Associate III Posi-tion, University of Rhode Island, P.O. Box 857, Kingusin, Rhode Island 92881-0337. An affirmative authoricipal opportunity employer An affirmative author/equal opportunity employer

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Bowling Green State University, Bowling Green.
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origin, diagenesis, and incramorphism of argillaceous sediments and whose future tesearch will complement our existing programs in the periodogy and diagenesis of sediments, experimental studies of compaction and of kinetics of burial diagenesis, he havior of clay minerals during deformation, petroleum geology, and stable into personnently. In addition to the development of a strong research program, the successful candidates expected to participate in all aspects of teaching and advising at the graduate and undergraduate levels.

The Department of Geology houses a variety of facilities for clay mineraling research, including x-ray diffraction and theoreticine units, including x-ray diffraction and fluoreticine units, in atomic absorption spectrophotometer, two NMR spectrometers, an isotope-tasion mass spectrometer, and electron microprobes. Numerous other analytical services are available on rampus, particulatly at the Materials Research Laboratory where there is equipment for Auget electron spectrometry, x-ray photoelectron spectrometry, x-ra

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Investigates the solubility/sorption behavior or radionuclides under the physicochemical conditions expected for a basaltconstructed repository. Requires a solid background in aqueous geochemistry and/or physical chemistry. Experience in environmental radiochemistry desired.

Geochemist

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William M. Rice University Geophysics and Re-flection Seismology. As part of a Rice University concentrate to develop further a modern Farth Sci-cace program, see plin to expand our geophysical faculty legislating in the standard granular such and are seeking to full three open proutons, including two erdoved that is We, badd to bould a train of collabo-tators interested in developing a new and our road. tators not cereat in developing a reason of collaboration indeed in developing a rew and normaling program of translate that is such a not reaching or reflection so renology and practs of capabilities, includes seconds of the processing frithmental to work with and much risks come point projects wall our geodogate is a sociated.

to appear of the ender twee the group will be "Joseful to decor in developing minorages graduate in direction of one currently, which are supported by the tradition of strength of the Mathematics. Mallaman of Seigness and Electrical Engineering

The group will also be expected to acquire and the kep accession processing center. Funds for the center and come round to a airly funds are already available, but an aggreeous viorch for additional research for the context of the lateral context in the context of the lateral context and funds are some after a context and the lateral context and the context and the lateral context and conventions and access the context and conventions are conventions. aged. There are also consulting oppositionines in

Salative and tall could be commensurate with qualcontrol into the control commensurate wire quantitations and e quantities. The are worth your cutting four-size, it so as to be specificate for highling a summate of experience in atomic processings, it short outliness of a research program you would like to make the control of the form of the four-size and many ordered between some references. conductable and many out of these or smore references to by A. W. Balls, Charmen, Department of Good-one, Rice University, P.C. Box 1892 Houston, Texas 772M.

Rue is an equal appointmitte employer.

Microprobe Technician-Operator/University of Maine at Orano. Subject to budgetate depended the Bepatitisent of Geological Sciences at UMO will faste they progressed analysis to February 1, 1965. Person appointed from the appelle of bringing on automored MAC 1966 professioning as a resulting material above the representative microprocessing Special and Science progressions. the account, about a "be to increase a miderate one incorpora-tions based at apparatus a with a mass agree principal begins be availed being geologic background for-fer red. I make apparatusers for one year with kiele-land of subsequent mappointment. Salars in the lange of \$17 also \$20,000 and Apple to CA-foundate. He partitioned of the sloping of Sections, Uni-sersors of Masse at Phonos. Throng Maine 101100. The University of Maine is an equal copporations afternative increase implicate. affengier action employer.

University of Arkansas/Tenure-Track Position—Structural Geology. Applications are invited for a tenure-track position in structural geology/tectonics, beganning August, 1981. The Ph.D. is required. Candidates who will strengthen our anticipated Ph.D program with research interest in field-uni-ented studies of rick deformation, rock fabrics for metamorphisms, or the tectonics of active margins which would complement growing programs in geophysics, sedunemation, and petrology are encouraged to apply. The successful applicant will direct graduate research and maintain this program with outside furtility as well as teach undergraduate and graduate tourses in surroutural geology and tectonics, an occasional course in introductors geology, and provide some support for the Montana field camp, Rank and salary are open, depending upon experience and qualifications. Applicans should subunt a resume and statement of learning and research interests directly and arrange to have at least 3 legion. regime and statement of teatuing and research in-terests directly and arrange to have at least 3 leners of recommendation sent to Robert C. Morris, De-partment of Geology, University of Arkansay, Fav-ettesille, AR 72701. Phone 501-375-3355. Deadline to all material is March 44, 1984. University of Arkansas is an equal-opportunity afbrusive action employer

Arisona State University/Postdoctoral Research Associate. Thermodynamics of places marinings, solid solutions, order disorder, glasses and melis. Prof. A. Navviesky, Dept. of Chemistry, Arizona State Univ., Tempe, A7.85287, 66021 965-4241. Aurora State University is an Equal Opportunity/ Allormative Action Employer

Space Sciences Laboratory/University of California, Berkeley/Assistant Research Physicist.

Apple atoms are being accepted for a position in the space playma theory group at the Assistant Research Physicist level A Ph. D. in physics, experience in playma unuslation and some brookedge of magnetospheric physics is required. The applicant should have experance in running particle simulation and MHD rodes remoted in a large computer. The initial appenament is for one to two vers; renewable therefore subject to continued furning. The salars range is \$21,100-23,200. Applications should include three names of references, and should be seen to Dr. Mary K. Hudson, Space helegaes Laboratory, University of California, Berkeley, Lalifornia 94720 and be received by February 29, 1934.

The University of California is no office of the property of California is not called the content of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is no office of the content of the University of California is not of the content o The University of California is an affirmative acCenter for Ocean-Land-Atmosphere Interactions: Department of Meteorology, University of Maryland, College-Park, MD The Department of Meteorology at the University of Maryland has established a center to study the interactions of occam, atmosphere, and land processes and their impact on climate variability, and in particular to study the feasibility of dynamical prediction of short-term climate fluctuations. Applications are invited from qualified scientists to join the center at its inception. The center has the following openings:

1. Assutant or Associate Profesor: One tenure track position for Ocean Modelling. The applicant should have good knowledge of oceanic and atmosphere dynamics, should also have the ability to develop ocean models and carry out research on variability and predictability of short term climate using coupled ocean-atmosphere models.

and predictability of short term climate using coupled occan-atmosphere models.

2. Assistant or Associate Professor: One tenure track position for Atmosphere Professor: One tenure track position for Atmosphere Professor: One tenure track position for Atmosphere Productability. The applicant should have good knowledge of atmospheric dynamics and should have demonstrated his ability to carry out outstanding research on Geophysical Fluid Dynamks. Contributions to the study of atmospheric predictability either using simple models or complex GCMS, would be considered desirable.

3. Research Scientist: One non-tenure faculty position to be supported fully by the grant funds. The applicant should have demonstrated excellent knowledge of atmospheric dynamics and general civilation of the atmospheric fully by the grant funds. The applicant should have demonstrated excellent knowledge of ground hydrology and interaction of vegetation and climate. Familiarity with upplication of land-surface process models in GCMs is desirable.

destrable.

5. Research Associate: One position for one year with possibility of extension for the second year.

The applicant should be a recent Ph.D. with interest in studying the dynamics of quasi-stationary atmospheric anomalies either by analysis of observed data or by analysis of model simulations.

6. Faculty Research Assistants: Three positions (two models) and considerations.

atta or by analysis of moder simulations.

6. Faculty Research Assistants: Three positions (two modelling and one for data analysis). The applicants should have at least M.S. in Meteorology and demonstrated their ability to work with large models and high speed computers. They should also have good understanding of synoptic and dynamic meteorology, and familiarity with modern techniques of processing large volumes of data.

Letters of application should be sent to:

J. Shukla, Chairman
Search Committee

Department of Meteorology
University of Maryland
College Park, MD 20742

Applications should include a curriculum vitae and names of three references, Applications received before March 15, 1984 will receive full consideration.

sideration.

The University of Maryland subscribes to a policy of equal educational and employment opportunity. The University of Maryland, under Title IX of the Education Amendment of 1972, does not discriminate on the basis of sex in admission, treatment of subdate of condensation.

Geophysics/Oregon State University. Applications are invited for a 12-month, tenure track position for an Assistant or Associate Professor of Geophysics in the College of Oceanography to complement the present eight member Geophysics faculty. The applicant must have a Ph.D. or equivalent, a demonstrated ability to conduct independent research in theoretical or observational geophysics, and to obtain research funding. Applicants will be considered in most areas of solid earth geophysics. Duties include teaching graduate courses in geobuies include teaching graduate courses in geo-physics, supervising graduate students, and develop-ing a program of grant-funded research. Interested candidates should submit a resume, names of three references, and a brief statement of research plans by March 1, 1984, to: G. Ross Heath. Dean, College of Oceatography, Oregon State University, Corval-lis, Oregon 97331.

Oregon State University, an affirmative action/ equal opportunity employer, complies with section 540 of the Rehabilitation Act of 1978.

Massachusetts Institute of Technology, Haystack Observatory Scientist/Engineer. The Haystack Observatory is seeking a Scientist/Engineer to work in the held of Very Long Baseline Interferometry (VLB). The Scientist/Engineer would assist in the development of new VLBI data acquisition electronics as well as assist with the processing and analysis of data taken for the NASA Cristal Dynamics Project. The applicant should have a Ph.D. or its equivalent in radio astronomy or related field. Some engineering knowledge and experience with electronics is needed and a knowledge of computer and microprocessor programming would be an asset.

Please write, enclosing resumes to:

J.T. Karaku
Assistant to the Director Haystack Observatory
Westford, MA 01886.

M.I.T. is an equal opportunity/affirmative action employer.

University of Oklahoma/Electronics Instrumenta-tion Specialist. The School of Geology and Geo-physics is accepting applications for a full-time Elec-tronics Instrumentation Specialist. Principal respon-sibilities will include maintenance, calibration and user instruction for a new, computer-automated Rigaku XRD-XRF system, and maintenance and Rignku XRD-XRF system, and maintenance and re-pair of electronic components of other lab facilities in the School. Additional opportunities could in-clude involvement in the University's electron mi-croscopy lab (SEM and TEM), and the development of a Van de Graaf-PIXE analytical system in col-laboration with O.U. physicists. Applicants should have a B.S. in Geology, Chemistry, or Electrical En-gineering or equivalent in experience; salary is com-mensurate with qualifications. Send curriculum vi-tae and names and addresses of three professional references to: references to:

ferences to:
Dr. David London
School of Geology & Geophysics
University of Oklahoma
Norman, Oklahoma 73019
Deadline for applications is March 15, 1984.
The University of Oklahoma is an albrinative ac-

University of Iowa/Faculty Positions. The Department of Physics and Astronomy anticipates two openings for tenure-track assistant professors or visiting faculty at any level in August 1984. In excepting faculty at any level in August 1984. In excepting faculty at any level in August 1984. tional cases a term or tenured appointment at the associate professor or professor level will be considered. Preference for one position will be given to an ered. Preference for one position will be given to an experimentalist in intermediate or high energy physics. Current research interests in the department are radio and optical astronomy and the following specialties in physics: atomic, condensed matter, elementary particle, laser, nuclear, plasma, and space physics. Faculty duties include undergraduate and graduate teathing, guidance of research students and personal research. Interested persons should submit a resume and a statement of research interests and arrange for three letters of recommendation to be sent to Search Committee, Department of Physics and Astronomy, The University of Iowa, lowa City, IA 52242.

The University of Iowa is an equal opportunity/affirmative action employer.

Middlebury College/Sedimentary Geologist. The Department of Geology seeks a person with skills in sedimentary petrology, sedimentology, and/or stratigraphy, for a tenure track position. Appointment will be at the entry level and will begin September 1994.

will be at the entry level and will begin September 1984. Letter of intent, resume, transcripts, and names of three referees should be sent, before March 1, 1984, to Brewster Baldwin, Chair man, Department of Geology, Middlebury College, Middlebury, VT 05753.

We are seeking an individual who is strongly research-oriented and who can complement the current petrology-tectonics interests of the department. The undergraduate program stresses field work and research. The curriculum is flexible and will be made compatible with the successful candidate's interests. The department has a fully automated electron microprobe, an XRF-XRD laboratory, and a vessel for studies on Lake Champlain.

Middlebury College is an equal opportunity employer.

Faculty Positions/University of Colorado. The Physics Department of the University of Colorado at Denver is recruiting for two tenure-track faculty positions to begin in the Fall Semester, 1984. The teaching assignment is anticipated to be two courses per semester, including involvement in the undergraduate laboratory program. A record of scholarly publications in refereed journals and a major role in our program development will be required for advancement.

A successful candidate will be expected to provide high quality teaching over a broad range of under-graduate physics comes to students who are highly motivated, and, because of our urban environment, somewhat older than the average college student. In addition, our department is developing a research program to support graduate instruction primarily at the M.A. and M.S. degree level. We are hooking for physicists with research competence in one of the following areas: geophysics, environmental science, applied solar energy, or non-linear phenomena. Applicanus should be willing to play a major role in the development of a strong physics department supportive of related disriplines such as chemistry, mathematics, engineering, and geology.

If you would like to apply to join our faculty, please see that we receive a letter of application, a A successful candidate will be expected to provide

o you would like to apply to join our occury please see that we receive a letter of application, a current resume, and three letters of recommendation. Applications must be postmarked before 23 March, 1984. Please note that you are responsible for him and the letters of recommendation and 10 March, 1984. Please note that you are responsible for having the letters of recommendation sent to us. Please send applications or inquiries to: Martin M. Mallempo Department of Physics Division of Natural and Physical Sciences University of Colorado at Denver 1100 Fourteenth Street Denver, Colorado 80202 The University of Colorado is an equal opportunity affirmative action employer.

1984

INTERNATIONAL SYMPOSIUM ON

OBSERVATION OF THE

CONTINENTAL CRUST

THROUGH DRILLING

Tarrytown Hilton Hotel

Tarrytown, New York

May 20-25, 1984

Sessions on the following topics: scheduled papers by invitation only: limited travel

Lamont-Doherty Geological Observatory

914-359-2900

Pallsades, New York 10920

Commission on the Lithosphere

The United States Geological Survey

The National Science Foundation

Lamont-Doherty Geological Observatory

Coordinating Committee on Continental Drilling of the Inter-Union

Sponsored by: Continental Scientific Drilling Committee

Geochemistry, Petrology and Mineral Resources

VI. Advances in Drilling and Logging Technology
VII. Recent Results from Scientific Drilling

Supported by: The U.S. Department of Energy

support for student attendees is available:

Deep Structure of Continents

IV. In-Situ Drill Hole Measurements

For information, call or write:

Review of National Drilling Programs

University of Georgia/12-month tenure-track facul-ty appointment in the School of Forest Resources. Qualifications: Ph.D in hydrology or forest hy-drology with at least one degree in forest resources. Background should include forest resource manageand quantitative sciences. Responsibilities ment and quantitative sciences. Responsibilities: Teach undergraduate and graduate level courses in forest hydrology and watershed management. Develop a research program in an appropriate area of forest hydrology. Rank: Assistant or Associate Professor, commensurate with qualifications. Salary: Commensurate with training and experience. Position available: July, 1984. Applications: All applications the presented to turn that the presented of term than the presented of the term than the term thad the term than the term than the term than the term than the te tion available: July, 1904. Applications: All applica-tions must be postmarked no later than I bebruary 1984. Submit resume, transcripts, and names of at least three references to:

Klaus Steinbeck, Chairman Hydrologist Search Committee School of Forest Resources University of Georgia Atliens, GA 30602 Telephone 404-542-1376 The University of Georgia is an Equal Opportunity/Affirmative Action Institution.

Oceanography/FSU. Assistant Professor in Marine Chemistry or Biogeochemistry, Chemical Sedimentology or Atmospheric Geochemistry. Applications invited for position starting with 1984-85 academic year. Contact by 1 March 1984: Chemical Oceanography Search Committee, Department of Oceanography, Florida State University, Tallahas see, FL 32306, Telephone: 944-644-6705. Ve are an equal opportunity employer.

Research Position/Department of Oceanography, University of British Columbia. Recent Ph.D. with experience in statistical methods and geophysical fluid dynamics sought to participate in the analysis and interpretation of data from an array of cyclesondes (profiling current meter, CTD systems) and current meters in the Strait of Georgia. The candidate should also have the potential of modeling the observations in terms of the non-linear low frequency motion of a stratified fluid of variable depth. The position is available as of 1 November, 1984, for a duration of one year and may be renewed for a second year; it will be filled at posteluctoral (va \$20,700) or research associate tup to va \$27,000) level according to the candidate's experience. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Renames and three letters of reference should be sent 1 July 1984 to Dr. S. Pond, Dept. of Oceanography, 6270 University Blvd., Vancouver, B.C., Canada Viil 1995.

Postdoctoral Associate/Meteorite Studies. The Harvard-Smithsonian Center for Astrophysics has a positionard opening for a well-qualified recent Ph.D. who wants to advance our understanding of the origin of planets by carrying out petrologic studies of meteorites. The appointment is for one year (renewable for a second year), beginning August 1. Familiarity with automated microprobe and yusi is essential; some previous exposure to cosmo-chemistry is desirable. Please send unquiries to Dr. John A. Wood, Smithsonian Astrophysical Observa-tory, 60 Garden St., Gambridge, MA. The Smithsonian Astrophysical Observators is an

Hydrologist. Come to the Pacific Northwest One of the leading companys in toxic, hazardous and emergency clean-up needs you John a progressive, established firm, new position, outstanding opportunity. Determine how to clean-up hazardous waste sites and spills. Determine subsurface and surface sites and spills. Determine subsurface and surface sucs and spins. Determine sitian face and writer water movement Supervise clean-up. Min. live-year experience, degree in hydrodogy or geolydrology and familiar with modelling. Company will relocate. For specifics contact: Dit. Dunnative, 503-542-2300 or write Murphy, Symonds, & Stowell, Professional Recruiting Agency, 1001 S.W. 5th Avenue, Portland, OR 97294.

equal opportunity employer

University of Arizons/Postdoctoral Research Post-tion in Planetary Atmospheres. Applications are invited for postdoctoral research posttions at the Lunar and Planetary Laboratory, University of Ari-zona, in Tucson, Arizona. The two positions will in-volve research in planetary physics and analysis of UV data from the Voyager mission. Research op-portunities for these positions include the bound and extended atmospheres and ionospheres of the giant planets and their satellites, the Io plasma to-

rus, earth's aumospheres, the interstellar medium, and the atmosphere and iomosphere of Venus. Applicants should have a strong background in theory and data analysis. Physicists and astronomers are encouraged to apply. Carriculum Vitae, lublingraphy and three letters of reference should be sent by March 1, 1984 to Dr. A. L. Broadfoot, Lunar and Planetary Lubertons. 1 Dispersion of Actions, 4893. Planetary University of Arizona, 1625 E. Ajo Way, Tucson, Arizona 85713 The University of Arizona is an Equal Opportunity Frenchests

STUDENT OPPORTUNITIES

Summer Assistantships/National Astronomy and lonosphere Center. NAIC will be conducing a Summer Student Program at the Arecibe Observa-tory in Puerto Rico. Areas on interest are Atmotory in Puerto Rico. Areas on interest are Atmospheric Science, Planetary Radar Astronomy, Radio Astronomy, Electronics and Computer Science. The assistantships are normally for ten weeks with the starting date being flexible. Graduate students and undergraduates who have completed at least three years of undergraduate training as of next summer are eligible. Travel costs to and from Puerto Rico will be poid by NAIC. Application forms, which must be submitted by February 1, 1984, are available from the Office of the Director, NAIC, Space Sciences Building, Cornell University, Ithaca, New York 14853. iciences Busta York 14853. Cornell University is an equal opportunity/affir-

Opportunity for Graduate Study in Igneous Petrology/Isotope Geochemistry—Southern Methodist University. The Department of Geological Sciences at Southern Methodist University in Dallas, Lexas seeks ourstanding individuals interested in a PhD program in Igneous petrology and/or isotope geochemistry. The successful applicant should have a strong background in geology, chemistry, and mathematics and an interest in solcanic processes. Research will involve participation in a heat-oriented petrological, geochemical, and isotopic study of Late Cenoroic volcanism in the Chilean Andes, for hutter details and applications please contact either:

Dr. R. S. Harmon (214) 692-3075

Dr. M. A. Dringan (214) 692-2752 Department of Geological Sciences Southern Methodist University Dallas, Texas 75275.

THE ARCTIC SCIENCE PRIZE

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS

The North Slope Borough is pleased announce the establishment of The Arctic Science Prize, The Prize (\$10,000) is to be given to distinguished scientists who have made significant contributions to man's understanding of natural processes in the Arctic. The purposes of the Prize are; to serve as recognition of the recipient's contributions, to further stimulate excellence in arctic science, and to focus attention upon the Arctic and its unique problems. An 11 member Candidate Review Committee will make the nominations

The North Slope Borough is a loca jurisdiction (county-like) that occupies most of the Alaskan Arctic. The Borough is very large (88,000 square miles) and sparsely populated (approx imately 9,000 people).

and select the recipient

Further information regarding the Arctic Science Prize can be obtained

Eugene Brower, Mayor North Slope Borough Box 69 Barrow, Alaska 99723

Actions at Hamburg

International Association of Meteorology and Atmospheric Physics

Reproduced below is a resolution adopted y IAMAP during the 18th General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Hamburg, August 15-27, 1983. Other resolutions adopted by IA-MAP at Hamburg were adopted by IUGG and reproduced in Eos, October 1, 1983.

The resolutions passed at each quadrennial general assembly of IUCG and of its member associations are an important barometer of current opinion in the geophysics community and can be a powerful tool in the development of the scientific programs to which they are addressed. The resolutions will help advance programs, however, only if they are used. Carried back home by the national committees which make up the IUGG, the resolutions can spread information worldwide on programs that promise to most effectively advance geophysical knowledge. IUGG and its member associations intend that incuber groups will present the resolutions before deliberative hodies and otherwise use them to make decision makers aware of international scientific thought.

The 19 resolutions adopted by IUGG as a whole appeared in Eos. October 4, 1983, p.

Resolution

JAMAP, noting that weather modification has been a controversial problem area for the scientific community because of the difficult interplay of scientific criteria and political and socioeconomic considerations;

noting that the scientific community nevertheless has a responsibility to give the clearest possible answers to society, whose needs for beneficial application of weather modification are manifest (as clearly stated by the President of IAMAP in his opening address: Godson, Hamburg, 1983);

noting that WMO has deferred the continuation of the Precipitation Enhancement Project (PEP experiment) because of:

 the inconclusive character of an evaluation of the selection please of the site in NW

 some fundamental scientific problems, in cluding notably the lack of knowledge of the precipitation efficiency of clouds and lack of ractical objective criteria for the modificabl fity of clouds, and

 the consequential shortage of support; but noting that a clarification, and hopefully resolution, of these problems may now be

and noting the potential importance of this subject to humanity, especially for developing

recommends that scientific research appropriate to weather modification (ram culancement) become a candidate for ICSC-WMO cooperation.

<u>Meetings</u>

AAAS Pacific Meeting

June 10-15, 1984 | 65th Annual Meeting of the American Association for the Advancement of Science (Pacific Division), San Francisco, Caht (John H. Vann, Dept. of Geography. California State University, Hayward. GA 94542; telephone 115-881-3193)

The deadling for abstracts is March 31. The Geology and Geography section has requested two sessions on the morning and at termoon of June 12, and all interested geologists and geographers are invited to offer papers on any subject related to geomorphology and physical geography

National Water Alliance

The National Water Alliance will hold its second regional symposium at the Scripps In-stitution of Oceanography in La Jolla, Calif., March 23–24. The establishment of a National Center of Water Resources Research and a Clearinghouse of Information on Water Re-

sources are the planned topics for consideration. These projects, which were identified as major needs at the Alliance's first symposom held in Philadelphia last September-October, will be open to panel and auchence dis-

The National Water Albanic was estab-Jished in 1983 by six congressional leaders to help resolve regional disputes over water and suggest alternatives. The congressional Couned on Environmental Quality is financing two studies of the proposed centers, and it is outrently putting out a request for proposals. from groups and organizations who may be interested in conducting the studies. The symposium will consider how these research. centers could best be used by business, by consumers, and by public interest groups. For more information, write the National Water Alliance, 50 "E" St., 8 E., Washington, DC 20003, or call Margo Warren, 202-224-4521.

The Geophysical Year calendar last appeared in the December 6, 1983, issue.

GAP

Separates

To Order: The order number can be found at the end of each abstract; use all digits when ordering. Only papers with order numbers are available from AGU. Cast: \$3.50 for the first article and \$1.00 for each additional article in the same order. Payment must accompany order, De-

Copies of English translations of articles from Russian translation journals are available either in unedited form at the time of their listing in EOS or in final printed form when a journal is published. The charge is \$2.00 per Russian page.

> Send your order to: American Geophysical Union 2000 Florida Avenuc, N.W. Washington, D.C. 20009

Aeronomy

Odio Composition (molecular)
ACCURACY AND PRECISION OF THE MITRIC ACID CONCENTRATIONS
DETERMINED BY THE LIMB INFRARED MONITOP OF THE
STRATOSPHERE (LIMS) EXPERIMENT ON NIPBUS 7
J. C. Gille (Mational Center for Atmospheric Research Boulder, Colorado 80307), J. M. Russell III, P. L.
Bailey, E. E. Renabarg, L. L. Gordiey, W. F. J. Evans,
h. Fischer, B. M. Gandrud, A. Girard, J. E. Harries,
and S. A. Beck
The LIMS is a six channel limb scanning IR radiomater flying on the Nimbus 7 spacetraft. It measured
radiances from 24 October 1978 to 28 May 1979, from
whith vertical profiles of tamperature, ozone, water
vapor, nitrogen dioxide and nitric acid were determined.
Mitric acid (HMQ) plays an important role in stratosoberic chemistry, both as reservoir and sink for the
nitrogen compounds, and bocause or its relationship to

the hydroxyl radical. This paper describes the validation of the MNO, results, beginning with an outline of the measurements and data reduction teading to the retrievals. The error sources due to instrumental effects and data reduction are described, and their effects on the results calculated. The prodicted random errors are shown to be somewhat larger than the observed values of ~ 0.10 poby. The LMS results are within 20. of a set of 15 correlative bailonn-barne measurements, obtained with several techniques over a range of sesson, latitude and pressure between 100 and 20 mb, the region of largest MNO, mixing ratio. This is about the accuracy of the correlative ressurements. The percond differences are larger at dittudes above 10 mb. LMS results agree with earlier measurements at all but the highest levels. Total overburdens above 200 mb calculated from LMS agree with those measured spectroscopically from a increfit. LMS and sees and a pertroscopically from a increfit. measured spectroscopically from alveraft. LIMS and other HNO, measurements show similar agraement with model predictions. The consistency suggests that the major LIMS error sources are reasonably well understool he HNO,/MO, ratio also leads to reasonable PK con-

The HID/No, ratio also leads to reasonable (M concentrations:
The global distribution in November shows strong
latitudinal variation at the altitude of the macinum,
with a large build-up over the Morthern Resisphere
role at - 40 mb, but lower values over the Southern
pole. This reverse by early Northern Spring.
Some characteristics and limits on the data are
noted, but the LIMS MED, determinations are usually of
comparable accuracy to other daterminations. These
rosults provide a valuable addition to our headedge
of the distributions of trace gases in the stratosphere. By themselves, but especially in conjunction
with the LIMS measurements of temperature, ozone,
water vapor and nitragen discide, they form the basis
for a wide range of stemspheric studies. (nitric
acid, limb scanning, infrared spectroscopy.

The National Center for Atmospheric Research is sponsored by the National Science Foundation. J. Goophys. Res., D. Paper 301981

Exploration Geophysics

OBJO Seismic methods
THE CHARGERISTICS OF REFLECTION TRAVELTIMES FOR SOME
LAYER MODELS
Bod S. Byun (ARCO Oli and Ges Company, P.O. Box 2819,
Bullas, TX 75211
The characteristics of reflection time-distance curves
varie examined axialy in terms of attacking velocity for
various single-tayer models. There were besteatly tree
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various timple tayer, and 1-D homogeneous curved layer,
plans dipping layer, and 1-D homogeneous curved layer.
It is shown through numerical experiments that a highly

stratified medium can lead to a large error in the estimates of the layer thickness if the stratification affect is impored. This error can be reduced in pert by approximating the needium with an elliptically anisotropic one. In the homogeneous but curved layer case, the coventional stacking velocity analysis yields an intremest bias in velocity with increasing surveture of the reflecting interface and with increasing local dip of the interface at the normal incidence point. Unless this bias is convected, the cames bix-type s this bins is corrected, the common DIX-Typo (ty estimation rechnique can lead to a significant

Geodesy and Gravity

1950 Relations of gravity observations to testonica and isostany REAST OSERVATIONS OF LINEARMERIC FLETCHE SERVARD OF TRESCREE D. C. Holdo (Goodgnamica Branch, Code 921, MAA Goddard Space Flight Conter, Greenbelt, Md. 20771).

Oction Spec Fight Center, Greenbelt, M. 2077).

C. F. Marin

Lithospheric flexure seaward of deep coses tranches
is evident is SESSIV slimeter observations of the sarine
goold. In fact, sechanical models of lithospheric
flexure can be tested directly on the SESSIV slimeter
data. We have used a simple electic model for the
socantel thosphere mod, after least equares eductments,
have resourced estimates of model parameters including
outer lithosphere model for a variength and affendirs
lithospheric blickmans. Effective lithospheric thicknesses
have been recovered for six regions: the Mariena, the
turil, the Palipping, the Meetien, the Tau-Sonia, and
the Middle instrice GB. These results support the
proposition that effective blickmans, T_{at} increases with the Middle larries Ol. These results support the proposition that effective thickness, T. Increase with the of litheophre in approximate according to the relation T w Grage where C s h know T. In fact, our limetric results agree our closely with this relation than do published results based on bathymetric data, The close agreement with the thickness-age relation suggests that there is no longer any send to assume that significant horizontal compression arts across though, Merians and Institutional account though Merians and Institutional across the facility is the community of the community of

The mathematical simulation of admitted the force the contaminant transport in any owners of distributions. For most of distributions for most magnetical module that is not transport model of the formation of the property of the following the small of the following the pattern error sportport of small of the following the The path-rel of electrical and industrial flater is examination or disputit, a constant large vertical to communion restroyen, the similated to ofthe compared with educated core. Colored character, for our tag. with times or person added the functions. When the second



Change address

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1984 AGU

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WEEKS

Meteorology

Althonourse Circulation (Climate Model)
A dispring from Lating South feet displayed from the displayed from Lating South (Atmospheric Sciences Mississen, Mississen, 1900), Automote America, Mississen (Lating South Carter, Mississen Lating South Control to protected and is concernated by applying it to shalp bettom I climate models. The action are treated, from first, a boston order, they concerned for the lating proposal in the state of the second case, they are action of the technique. For the second case, they have a considered to be lating and they not concerned to the lating and action for the control of the Mississen action and the lating action and the second case, and they are action of the physical action of the control of the physical action of the physical action of the physical action of the physical action of the control of the physical actions and action. (Climate model, variational, annual cycle). The training Money of Albertainer

Mineralogy, Petrology, and Crystal Chemistry

AldO Faragenesis. Detrography, end potrigenesis STM-GRAPH AND CRESTICATION OF CALL-PICH AND CRESTICATION OF CALL-PICH AND CLUSTERS IN TWO ALLEST CAS COMPARED A. N. Forcets (The thorniam America) activities the control of the contro Stiete aggregates (Tage 12 inclusions) and remed clients aggregates (Tage 15 inclusions). We classed Ca.Airrich inclusions (CAT'm) on the house of the citains aggregates (Type 15 to justices). We classify Ca.Airrich instruction (CAT'm) on the basis of the size at a standards of train constituent concentral objects instance of train constituent concentral objects into extensive than their grein size) into unclassed complex rather than their grein size) into unclassed complex intra the at a size at inclusional, masses of the into him, disparsy grade into each other. Come for label with one of many grade into each other. Come for label into a relation and disparsed, the suggest that the term 'name grades,' see if used only in a salaries serve, is the architecture for a see meeters of consideration for a second consideration of another objects and interesting consideration, in the consideration of the interesting consideration, in the constant constant in the interesting objects of the consideration.

Oceanography

Exist Circulation of All Controls of State Manager Controls of State Manager of Manag

ally in entering the sill between Memoria The learning of Stanty by My Michael A right System State And that he wise and a time of the Sense, March Research that to, Memoria and a right An Obstation, Marchington, On 1987 we externe the tr first Steple where fireersuction

spectra at different places within a fulf Stream Ping. If N is the Brunt-Valsala frequency and $N_0=1$ cph, we find spectra from different dapths collapse fairly will with bigh the $(NN_0)^3$ and $(NN_0)^3$ scaling, and roll off so \times \times^2 . Scaled displacement variances $(NN_0)^3 \in \mathbb{C}^2$ in = 0, 1, 2; $N_0=1$ cph formed from the wavenumber decade 0.04 \in \times 0.4 cpa are regressed upon the vertical manuscular shear, it is found that when n=0 or 1, the scaled warface and the shear are negatively correlated but the potential source (n=2) and the shear are urrarrelated. An explanation for the correlation when n=0 is offered using simple linematic and dynamic arguments.

argumeta. I. terphyp. Res., t. Piper 400026

4760 %s for presented the concentration is determined to the concentration of the concentrati ice Precion is encounter than the spectral year high is the difference of the 0.91 cm and the 1.7 cm vertically polarized radiances divided by their sun, in addition, an ice tenegrature is calculated from the 4.6 cm vertical channel radiances. The use of radiance ratios orwally reduces uncertainties in the derived parameters resulting from temporal and horizontal special and soften radiances from selected areas in the Arctic region for the parint Petrusy 1-7, 1979 are used in computing alignments coefficients. Polar mass of sea ice concentration, multipear fraction, and ice temperature are illustrated for this period. The variation of the mean and standard deviation of ice concentration and rultivers ice fraction for a region of two personal ice concentration for first elementation with the mean for the computed concentration with the mean for the computed concentration with the mean for the concentration that the mean for the concentration is also presented. The standard deviation about the multipear fraction is about the first elementation veries from 25 to 55 over the placem month period is indeterminate largely because the question between first-year and multipear sates during this symmetries are successful to the first element the gradiant of the concentration and sulfityer fraction for the central Arctic region and on an analysis of historicas of these parameters, the precision of the other parameters and information the concentration and sulfityer fraction that calculated are too parameters, the precision of the other parameters and information the control of the multipear fraction in the range of 1-25t, fongerisons are rude between the calculated sea too parameters and information the source precision and the source of the first parameters and information of the source are not the multipear for the precision of the first parameters results uncertain. The precisi

476) Degregação (Instruments and Techniques)
COMMENT UNITAM INSTRUMENTA APPROVACH TO SIGNAL CORRESTATION BY D. G. STARTINAIN, W. MENNE, AND P. STOFFA,
TO ON THE UNITAM STARTINAIN MAINTE AND P. STOFFA,
MAINTE STARTINAIN

From these (Woods Hole theringraphic Institution, Woods Hole, MA 12440, Marc 13 thase. In a story caper, Matinoon et al. (1982) proposed a quantitative received for econotring the mapping function which makes a distorted time a series capember a reference series using a carameter customation across to the communition tone limitations and carameter customation and table of the communition to the limitation of institution of their appropriation and add to artificial. In high frequency singlifices of the traction of fraction will lead to artificial. In high frequency singlifices of the traction of the traction of the traction of the community of the traction of the data. The content of the data is necessary to remain the problem into one of the rational registration with local equality constitution and parameterization of the data. The registration of the data is neveral the problem states and parameterization of the data in the reference of the traction of the data in the receivable of the traction of the data in the receivable of the traction of the data in the receivable of the traction of the data is not received by the receivable of the data in the state of the data is the traction of the data in the state of the data is the traction of the data in the state of the data is the traction of the data in the data i

Particles and Fields— Ionosphere

a trouble of facility to hipper species.

PALE-TIP. DISTABILITY OF DISTRICT AUTOMAL PIELD LINES
H. Italia (Princeton University, Planna Physics
Laboratory, Trinceton, uj 19544), J.P. Yan and S.-T. Total a typical external substors, there occurs a little scale deformation along the polar boundary of the diffium externs resident in the arcelled onese band. It is storm that the formation may be a result of tall anny fratability penerated by the curvature of the dipolarithe superior field in the plane sheet. The could be the curvature of the could be a result of the little for the court of the instability is derived using a simple plane corporation model associated with



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E. M. Dewan, N. Gressbard, A. F. Quesada, and R. E. Good

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Manfred A. Blondi 84

The Orocline Hypothesis Versus Thin Skin Rotation in the Central and Southern Appalachians (Paper 3L1872) Ina B. Altermia 88

Susan Y. Schwartz and Rob Van der Voo

a substorm. Theoretical predictions on the location of the instability, propagation speed and the time scale required to develop large structures are in good dyreament with observations. Iballooning lastability, diffuse guroras, substormal, J. temphus, Pess., A. Paper 4A0089

5520 Electric fields
kESULTS ON KELATIVE SCATTENING CROSS SECTION
OF 140 MAY AURORAL BAYSSCATTEN
C.I. Maldoupis (Max-Flanci-Institut für Aeronomie,
D-3311 Katlenburg-Linduu, FNG, and E. Mielsen.
Observations of power spectra and backscattered signal intensities associated with auroral electron density fluctuations with scale length of nearly one meter have been rade with STAME [Scandinavian Twin Auroral Radar Expairment]. The intensities of the backscattered signals, which are related to the radar scattering cross sections, which are related to the radar scattering cross sections, have been enalysed to determine their angular distribution in the plane perpendicular to the magnetic field with respect to the direction of the electron drift valocity, in the analysis, the Doppler spectral characteristics of the data are used in order to identify the type of irregularities. It is found that the primary irregularities, having merow spectra centered at large Doppler shifts, have a highly anisotropic scattering cross section as curpared to the secondary one-meter waves. The strength of primaries is large and strongly dependent on flow angle 0; typically the intensity decreases from 0.3 to 0.6 dB/degree with 8 intensity decreases from 0.3 to 0.6 dB/degree with 8 intensity, the intensities of the secondaries are relatively weak and rather insensitive to engular variations. We find the ac-variation of the backscatter amplitudes associated with primary and secondary irregularities to be closely correlated. This indicates a common modulation mechanism to dominate for the two linds of scatterers. (Electric fields, plasma instabilities, redar aurora).

5340 Ion densities and temperatures
10505PHRIC CHEMISTRY OF NO?

E. L. Brig (Physics, Space Sci., Univ. of
Texas at Deline, Richardson, TX 75083), W. B.
Harmon, and J. H. Moffman
An investigation is described of the behavior
of No? in the depties 7 region, with besic los
concentration measurements from the Atmosphere
Explorer C extellite. The data set was acquired slong swises orlier at low intitudes and
exhibits substantial variations in the No?
concentration, both along and between nearby
orbics. An excellent consistency is denomstrated between these observations and current
themical equilibrium theory, in contrast to differences that have beso reported for the related
No? ion. Large variations in the concurrently
observed electron temperature permit a televant
comparison between different laboratory datarminations of the dissociative recombigation rata
coefficient. Contributions to the No? production from several secondary sources are also
evaluated. Essuits strengthen the basis for the
current theoretical ionospheric chemistry of No*
and establish important constraints on resolution of the difficulties with No?, (No*,
photochemistry, ionospheric, lon concentrations)
J. Popion. Sec., A. Papor JA1941

5545 Ignospheric Disturbances SCINTILLATION RESULTS FROM IOMOSPHERIC MODIFICATION EXPERIMENT SCINTILATION RESULTS TROM IONOSPHERIC MODIFICATION EXPERIMENT
A.L. Johnson and A.M. Hocutt (Avionics Lavoratory, AFVAL/AMI, Wright-Patterson AFB, blio 45433)
During September 1962, a group of U.S., Mest German, and Brazilian organizations evaluated the trigger mechanism of equatorial ienospheric bubbles in an ionospheric modification exporiment in Brazil. The experiment involved the release of two barium chamical vachages at an unstable point in the night-time Flayer. At this point, they would trigger a bubble of low ion density to rise into the pid and upper Fregions. Following the release of the barium, an aircraft equipped with a URF stellite receiver was flown in the shadow of the bubble, it mapped the growth of the resulting irregularities from their initial appearance until they grow to a width of 100 kilometer or more. The experiment demonstrated that hubble could be triggered by proper placement of the harium tons and that the resultant (rregularities would have the appearance of naturelly triggered equatorial ignospheric irregularities. [ionospheric medification. scintillation, dirborne measurements, Coloured Bubbles).

5570 Total Slection Content
DAI-TO-DAI GRANGES IN ICHOLSPHERIC ELECTRON
CONTENT AT LOW LATTURES
B. S. Babas (Radio Science Division, National
Paysical Laboratory, New Dolhi-12, India),
P. K. Huyan and T. D. Tyagi
a. Z. Bardway (Physics Department, Eurukanetra
University, Eurukanetra-152 119, India), and
The day-to-day variability in ichospheric
electron content (ISO) is studied using the
Siural ISO startms (IRCa-2) data; obtained
Locaseltis tations (located in the latitude
Exarge to tween 19,10 and 30,70 is Indian spice

during solar minimum. Depending on the location of the observing station, the changes in ISGmax values, from about 120 to 40 percent are found to occur in the form of sincle day abnormality, alternate day-to-lay fluctuations and long term periodic fluctuations. The magnitude of fluctuations is found to be maximum at a station, which is near to the crest of the equatorial anomaly belt. The long term periodic variations, other than annual and semiannual variations, at different for different locations and seemsons and show a periodicity of about 45 days in winter in the equatorial anomaly region only and about 27 days in summer at all the stations. The onanges are not always correlated with solar or magnetic as well as long term variations in INGmax at stations within and near the creat of equatorial anomaly belt are controlled sainly by the electrojet strength variation. At locations which are north of the creat of the anomaly belt, some of the changes in ISGmax which come under the category of single day abnormality, are also caused by the influence of equatorial anomaly. Other changes, at these stations, which cannot be explained on the basis of electrojet strength variation, may be caused by other effects such as colar and magnetic activity changes, large scale iconspheric disturbances and the muspheric compositions and temperature changes. (Innospheric strength).

Pad. Sci., Paper 381861

Particles and Fields-Magnetosphere

D705 Now Shook Naves
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D705 Now Shook Naves
D706 Nave Shook Naves
D706 Nave Shook Naves
D706 Nave Shook Naves
Staves J. Schwarts and David Burgess (Department of
Mpolice Mathematics, Queen Mary College, Mile End Rosa,
London El 488, England)
We demonstrate that the de Hoffman-Teller frame, the
transformation for which removes the metical VNB
slocking field while Newping a planar shock at rest, is a
legical choice for data analysis. Frawious comparisons
between Local planar theories and observations of
Sackatreaming ion beam velocities are streamined and
ralated directly to the one physically meaningful angle,
that between Libe segmetic field and shook normal. by
transforming the data into this frame. Our limited data
sat suggests that both reflection processes and leakage
ones may be operating at different times. A larger survey
equipying the techniques described here could provide
confirmation of our tentative conclusions. (Now shook,
ion beams, de Hoffman-Teller frame)
J. Coophys. Ras., A, Paper AAOBSI

5799 General (Lonsephoric and magnetospheric heating) EXCLINION OF MACHETOSTATIC FLUCTUATIONS BY FILAMEN-TATION OF WHISTLERS

TATION OF MINISTERS
N. C. Lee (Regie College Research Center, Weston,
Massachusetts O219) and S. P. Kue
The thermal (Hamentation instability of whistiers
that can excite magnatostatic and plasma density
(Juctuations simultaneously has been investigated for
cases in the magnatosphere and in the ionosphere. With
the saniabile [ecilition at Siple, Anterctics, this
instability may be excited in the magnatosphere at Lei
within a few minutes by ducted whiteler modes whose
frequencies are greater than half of the local
electron cyclotron frequency. No significant ionospheri
offects are expected to he produced by the injected
Siple VLI waves. However, marked lonospheric perturbations are predicted with employment of envisioned
AF transmitters at frequencies slightly less than the
electron cyclotron frequency in the lonosphere.
Thermal filementation instability, wasperostatic
fluctuations. Plasma donsity (Juctuations).

5. 4-eophys. Pag., A, Papor 440019

579 General (Magnetic Reconnection)
MAGNETIC FIELD LINE RECONNECTION EXPERIMENTS
PARI 6. MAGNETIC TURBULENCE
W. Gekelman (Physics Department, University of
California, Los Angeles, Los Angeles, California,
90024), R. L. Stenzel

Extensive statistical analysis of the vector
components of fluctuating magnetic fields have been
performed in a line dependent neutral magnetic sheet.
Cross spectral analysis indicates a variety of
wavenumbers present for each frequency investigated.
Comparison of Fouries components of the cross
spectral function with dispersion surfaces in R
space demonstrate the waves are large amplitude
whistlers; this is venified by polerization analysis
which shows the random waves' magnetic fields to be
right hand circular, lon acoustic and tanguair
turbulance are also observed along with bursts
of microwave radiation. Measurements of the
electron distribution function (fer.), and its
fluctuations in webocity space relate wave and
particle massirements).

Physical Properties of Rocks

6110 Elasticity, fracture and flow

"PRESSURI SOLUTION" CREEP: SOME CAUSES AND

RECKANISMS.

R. V. Green. II (Department of Goology, University
of California, Davis, CA 95516)

Despite the wide-spread evidence of arresscontrolled dissolution and practition is
diagenetically altered and low-grade extanciphic
rocks, a great deal of controversy recains
concerning the driving forces and transport
pechanisms involved. To clarify the various driving
forces, the Free Enthalpy equation is expanded here
to allow identification of different terms
contributing to the overall phenomenon. It is argued
that under diagenetic conditions, acress
concentrations at grain-to-grain contracts will be
the largest source of chemical potential gradients
and that upon burial and cepeciation, these
inhomogenetries decline and the orientation
dependence of normal stress in a quasi-homogeneous
acress itald becomes important as well. These
mechanisms operate efficiently enough under these
relatively cold, M.O-rich conditions that stresses
can remain below the threshold for crystal plastic
deformation. Mater on grain boundaries provides at
the vary least a high diffusivity path, and in cases
of large volume losses must also contribute directly
through fluid flow. Not experiments work on this
phenomenca has not distinguished carefully between
streas-enhanced solubility and solubility
enhancement due to pleasite deformation of
microcracting. A new thermodynanic analysis of the
results of acone seperiments by Sprunt and Kusungests that in at least some of their experiments,
true pressure-solution creep has been activated. A
related phenomenca, volume transfer creep during
phase transformations which involve stgriftcant
volume change, displays many of the characteristics
of pressure solution.
J. teophys. Ros., B, Paper 480061 of pressure solution, J. Geophys. Res., B, Paper 4B0061

Planetology

6950 Meteoritics MORPHOLOGY OF THE OUTERMOST SEELLS OF THE MORPHOLOGY OF THE OUTERMOST SEELLS OF THE TUNIDETA BLACE MACHETIC SPHERULES Mizbik (deology Department, warsaw University, Zeirki I Wigury 95, 02-089 warsaw, Foland/A sample-population of 100 black magnetic spherules from the area of the Tunguska event of 1908 was examined by ESA techniques, According to their sorphological features they were subdivided into saveral types : compact, rough, regolith-like, mosaic and "satrakhan-coated".

-coated"

After electron-microprobe-assessed Hi-content two largest spherules and two accompanying minor ones were found to be extraterrestial. Extraterrestial are likely spherules
two regolithelike ones and one "astrakhan-sohad".

ated".

It is hypothesized that the link between the Tunguaka body and spherule morphology is to be searched in spharules resembling ablation products of iron metoorites. /Tunguska apherules, Tunguska event, black magnetts apherules/. J. Goopbys. Res., B. Paper 385027

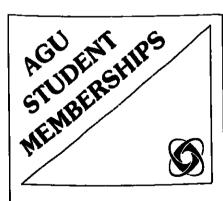
6575 Seriese of planets

EPECTRAL PROPERTIES OF ICE-PARTICULATE MIXTURES AND
IMPLICATIONS FOR REBOTE SENSING I: INTIKATE MITURES

E. H. Clark (Planetary Geosciences Division, Saveil

BECTUAL PROPERTIES OF ICE-PARTICULATE MIXTOES AND
IMPLICATIONS POR REBOTH SHOWS IN INTERIOR SHOULDES.

A. C. CLEY (Planetry General sees Division, Reveil
Institute of Geophysics, Daivership of Eventil
Reported, Havell, 9923), P. O. Lesy
The spectral properties of water ise-particulate mixtures are studied for the parpose of deriving the interior of genius). Reflectance from results obtained appropriate to facility of the continues and the should show the state of the particulates and itse should show the state of the particulates embedded in the case should show the state of the case of the particulates of the should show the state of the case of the state of



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.bandense). I. Loophya, kus., 8, Paper 381430 1. Loophya, Rou., 8, Paper 381410

bi99 General (Mare Saualt Formation)
La-Mi Abb Sm-3d Evolution of Lugar Harf Ragains
D. M. Durab (U.S. Goological Europy, MS On), Mar 1806b,
Fed. Cir., Denver, CO, 20225), P. Stille, P. J.
Fatcheti, and M. Tatacoto
Lu-Mi and Sm-3d data for more bisalts combined with
Rh-Sr and total RF, data taken from the literature
suggest that the rare bisalts were derived by small
(*161) dugress of partial melting of consists sources,
but that the rare bisalts wish durable sources,
but that the rare bisalts wish durable sources
formed was light REE and Mi-enriched. Colculated
source compositions range from heredite to cliving
websteries. Nourodal melting of anali annumts of
livenito (*37) in the sources seems to be required by
the Luffi data. A comparison of the MF and Md isotopic
characteristics between the more besalts and
terrestrial counic besalts reveals that the Mi(*CM)
ratios in low-Ti mare basalts are much higher that in
terrestrial occanic basalts. The results are
qualitatively consistent with the hypothosis that
terrestrial besalt sources are partial mult residues Queternery). J. Geophyn. Pub., B, Papur 480057 whereas were openit sources are completed. Alternatively, the rounits may imply that the torrestrial contile has evolved in two (or more) stages of evolution, and that the net effect was depletion of the mantle during the first ~1-) by, followed by enrichment during the last 1-2 by,; for simply that there is a difference in Lu-16 crystal-11quid partitioning fraintee to So-24) between the lunar and serrostrial contine. terrestrial manting. J. Goophym. Rum., B. Paper 385054

6599 General (Lunar Basalt) Lu-HK CONSTRAINTS ON THE EVOLUTION OF LUNAK BASALTS
H.FUJIMAKI (USOS, MS 961, BOX 25046, DPC, DERVER CO 80225) and M. TATSUHOTO M.FUJIMAKI (USOS, MS 961, BOX 25046, DFC, DERVER CO 80215) and M. TATSUMDTO
Very low Ti basalts and green glass samples from the moon show high Lu/Hf ratios and Low Hf concentrations. Low-Ti lunar basalts thow high and variable Lu/Hf ratios and higher Hf concentrations, whereas high-Ti lunar basalts show low Lu/Hf ratios and high Hf concentrations. KPECP basalts have constant and low Lu/Hf ratios and high but variable Hf concentrations. Using the Lu-Hf behavior as a constraint, we propose a model for mars basalt evolution. This constraint requires extensive crystallization of the primary lunar magma ocean prior to formation of the lunar magma ocean prior to formation of the lunar magma ocean prior to formation of the lunar magma ocean. Lu and Hf concentrations and the Hf inotopic date of lumar rocks suggest that assimilation cannot be accepted as a major process to explain the diversity of the lunar mare basalts. The urKEPEP hypothesis is also unnecessary. Both high- and low-Ti basalts show sufficient iron enrichment to be regarded as as selicing products of the last stags cusulate rocks from the lunar magma ocean. The FREEP basalts are also iron-rich and may be redarded as the final residual liquid left after the crystallization of the major portion of the primary lunar magma ocean. (Lu-Hf systematics)

Seismology

6970 Structure of the crost and appear matter PROPAGATION OF PL AND IMPLICATIONS FOR THE SIPECTURE OF

6973 Structure of the earth's interior below the upper mantle

BLAS PENETRATICN INDO THE LOWER MANTLE

K.C. Creager and T.S. Jordan (both at Scripps institution of Oceanography, Ls Jolle, CA 92091)

To investigate whether or our lithoupharic clabs
descending along subducting margins penetrate below the
670-ks saismic discontinuity, we have analysed 4040 P
and PKIES cravel tissen from 16 Internadiate—and deepfocus sarthquebes in the northeastem Pacific and
obtained setimetes of the near-scores sconely as a function of position on the lower forch hamisphers. Station
and slipsicity corrections are applied, and any conponent of the anomaly explicable by hypocenter mislocation is reserved by orthogonalization of the residual
vector with respect to the location parameters; the
resulting residual sphere is shouthed and laterpolated
by a stochestic fillering achase to average out observational errors and the effects of small-scale harrogenericies for from the source. The smoothed residual
spheres for wis Sea of Okhotsk carthquebes desper than
500 km are dominated by MK-Si trending vroughs of gensities for from the source. The ambouted results appears for six Sea of Ohlots describuedans despet than 500 km are dominated by MK-Si trending troughs of ungative ancesites having strikes and dips shallar to the subset cans at these depths; the troughs are houseded on the NY and SE by serallel ridges of positive anomalies, with peak-du-trough amplitudes averaging about 1.5 s. As the fucal depth decapanes, the pattern about 1.5 s. As the fucal depth decapanes, the pattern framilates to the NY, so that for hypograntars sear 200 km the segative trough has been replaced by a positive ridge. The axis of the anomaly pattern for two Sea of Japan desperious satthquakes is rotated counterlock-pins from Othersk, comsistent with the unsely atthe of the Japan selsmic most. These correlations, and the fact that one nearby earthquake not within a subduction zone shows very little enomally, suggest that the residual-sphere anomalizes are caused primarily by also bettrogenestry. Forward modeling experiments corroborate this conclusion. The thermal disturbance of the months is calculated for an escaped liew field by a finite-difference algorithm, and from it a model to F-vellocity betarogeneity is constructed; theoretical rravel-time relocated and the residual sphere anomalizes and the avent is relocated and the residual sphere amounted to the observations. To obtain a good fit to the despendence of the same fattlen set und by the same algorithm applied to the observations. To obtain a good fit to the despendence of the same fattlen set and by the same algorithm applied to the observations. To obtain a good fit to the despendence of the same fattlen set and by the same algorithm applied to the observations. To obtain a good fit to the despendence of the same fattlen set and by the same algorithm applied to the observations. To obtain a good fit to the despendence of the same fattlen set and by the same algorithm applied to the observations and one greater with the S-wave results of Jorden [1977]; if toglies the citeval ther

J. Geophys. Pes., 8, Paper 480045 6999 General (sorface faulting)
PATTERNS AND TIMING OF LATE QUATERNARY FAULTING IN
PATTERNS AND TIMING OF LATE QUATERNARY FAULTING IN
BOOLOMAL TECTORIC VALUES
ROBERT E. Weller (S.S. Geological Survey, Mealo
Path, CA 94023)

Large-scale surface faulting stants, each tens of filosoters long and involving sore than a meter of displacement, of late Qunterrary age have not been uniformly distributed but have been concentrated in subprovincial and sublier bits and areas within the Great Sasim province. Furthermore, faulting apparently has not been unifously distributed over time. The avarage recurrence interval of large-scale faulting svents no individual faults in the province is created in thousands of recurrence interval of large-scale faulting svents to with long recurronce intervals, in the central Buside and caterra California salende belts large-scale faulting events have occurred during the last 111 years in an apparently scherent, sequestial belt-tilling pulse of activity in which events were maparated by only a faw years or a faw decides. The questions are, where are other pulses of large-scale faulting likely to occur, and what controls the localization of such belts and areas obstantarised by higher rates of faulting?

Two exampless of tectonic subproviences that may play a role in delibiliting smaller tones of faulting are the Black Sock-Carson Sink zone of extension and the central havada obovourp. The central Howada signale belt lies along the dividing lies between them two subprovinces, and the northwest margin of the Black Fock-Carson Sink zone of extension coincides with the margin of a fingaritie belt of dones indicting in outhouse term Newsda. (Surface laulting, Great Basin, Quatermery).

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Social Sciences

7:10 Repromies hold Reports of Biochipecat oxygen behand under transferable discrance Perset Processes. E.D. Brill, J. 18ept. of Civil Engineering and Institute for Environmental Studies, University of Illicots, Urbans, Illinois 61601), J.W. Ehoset, S.R. Zahiranger, and B.J. Ladre

Bischemical oxygen second is an important emple of water pollutant; that degrads blockedically and affect water quality according to the location, as well as the strength, of the discharge, it is therefore hoperant to examine carefully the polential water coality impacts of a progres of transferable discharges prior to the lopiwamitation of such a progres.

This paper provides a framewith for confusing these impacts and illustrates trade-offs with respect to breting water quality goals. Famples growing fifteening, equity, and uncertainty with respect to breting water quality goals. Famples are given for the Delawire Siver Estimaty and the Willagette Sheer. It is shown that violations of the standard could according to the st

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Tectonophysics 8130 Plato tectoules CENTRUC PLATE MOTIONS AND THE VOICANO-TECTONIC EVOLUTION OF WESTERN ORGANIA WASHINGTON

CEMIZORI: PLATE MOTIONS AND HIE VOLCANOFECTORIC BYOLLTEND OF MESTERN OREGOR AND MASSIRINGTON

R. F. Weits (U.S. Groin-post Survey, 115 Mushisfield Rd., Menio Fark, UA 24020) D. C. Engetrotson, P. D. Snavely, Jr., and R. S. Cos.

A refinced northeses Facific plate-motion model provides a framework for analysis of the fertiary solemnia and tectoric history of western Oregon and Massington. We canning the possible models for the origin of the allochitomous Paloceone and Econes occaning basels become of the Costs Renger. I) accretion to the continent of hot yest generated linear scamounts generated during Faration-fixin spreading reorganizations between \$1 and 48 Ms and 3 empition of basels thating obligate rifting of the continents inorgin as it overrode the Vellowstone bot yest on the Kuis-Faration ridge. The plate model suggests that micropials relation and accretion of hot yest generated linear ascisone ridges cannot be easily reconciled with rapid sortheast modion of the Kuis and Faration plates and the well retablished paircomagnetic rotations. Following emplacement of the Costs Rango baseness, changes in the character of forcare, backare and Cascade are volcanous correlate afths marked decrease in the rate of Faration-flucth America is averagence between 43 Ms and 23 Ms. This standard may be regionable for: (11 activard stepping of the volcanous are from from the Challis ass to a Cascade exist an irout 12 Ms. 121 assistance of the Cannot are factored at 1 and 13 4 Ms. 13 assistance of the Result in the volcanous and extension in the Cannot are factored at 1 and 10 at 14 Ms. Reduction of the convergence rate and accretion in the stare in the substitute value and accretion of the force of the Resure in the substitute and allocated pair mercased injection of magna and account development of large, shallow magna channers, and the outbreak of extensional volcanous areas development of large, shallow magna channers, and the outbreak of extensional volcanous areas and the control of large shallow magna channers,

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